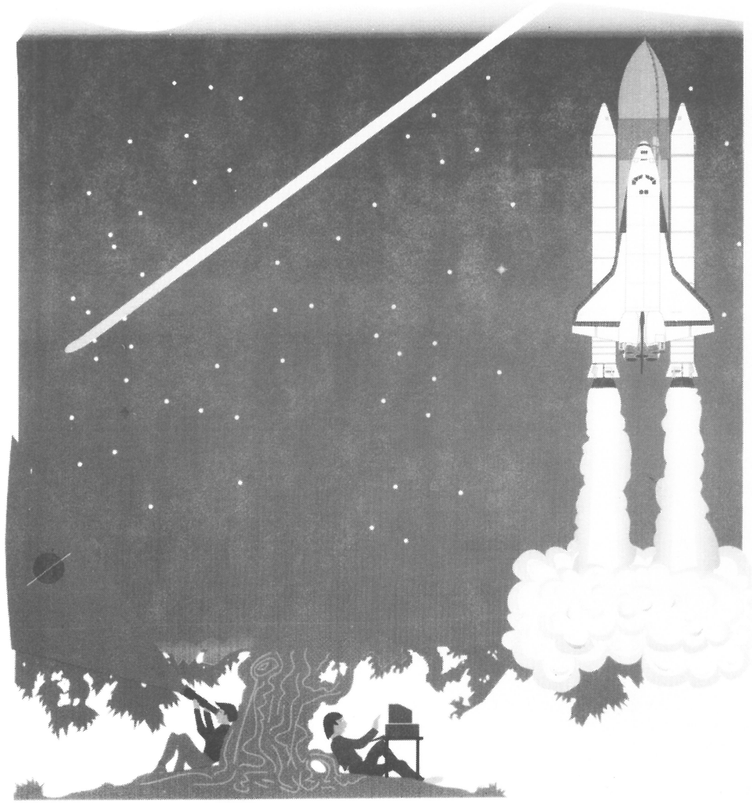
Adventures in Astronomy



Teacher's Handbook

ENTREX

Search & Solve Series

Adventures in Astronomy

Entrex Software Inc.
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Victoria, B.C., CANADA, V8X 5E1

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Part One

Using the Simulation

Introduction

Welcome to *Adventures in Astronomy*, a computer simulation game for ages 9 and up. In this fanciful new adventure program from Entrex, you'll soon be enrolling at the Humble Space Academy, a training facility for better astronauts everywhere.

Once you pass the entrance exam, you will start a whirlwind training program which will take you to the moon, under the ocean, and across the solar system. You'll investigate eclipses and tides, learn to judge seasons (so you can fly home from Jupiter in time for Christmas), and experiment with gravity. With each successful assignment, you will earn awards and promotions towards the much sought after (and rarely won) distinction of being named a spaceship astrogator.

Are you ready to bravely go where no person has gone before? If you pass our Humble courses and become a spaceship pilot, you'll be the envy of all your land based friends (some of whom probably still think the Earth is flat) and a hero to small children who will follow your every exploit.

So, sharpen up your calculator, click on your pencil, and boot up your computer with *Adventures in Astronomy*—we'll be leaving for the moon in just a few minutes. Are you ready for your first "out of this world" adventure?

Astronomy encompasses the following features:

- ease of use: commands are selected from pull down menus
- background information on astronomy and related subjects
- special utilities for record keeping and the analysis of student progress
- constant and informative feedback through both text and graphics
- special design for use individually or in a lab setting (5.25" disk versions only) — the program can be used on any number of computers simultaneously

This program is geared towards science classes in the grades 4 to 8 range. The reading level of the background material is rated at 6/7 (exclusive of technical terms). A glossary is provided for younger students.

Aims and Objectives

The aim of this program is to assist students in grades 4 to 8 in learning about astronomy, heavenly bodies and gravitation. The program will provide insight into the mechanics of tides, eclipses, orbits and trajectories. Ultimately, students will pilot a spaceship right across our solar system.

Information is presented in three ways:

- by completing the different assignments at the Space Academy, students will gain an understanding of the solar system, its size, and the placement of Earth within it.
- in reading the handouts and answering test questions, students will learn about early theories on the structure of the solar system, will gain insight into its physical structure, and will be introduced to the theories of Copernicus, Kepler, Newton and Einstein.
- in viewing the graphics the student will gain a visual appreciation of the solar system, the moon and its phases, comets, eclipses, etc.

The program will be most effective when used in conjunction with filmstrips, textbooks, and studies out of doors.

Knowledge Objectives

Upon completion of the simulation, the student should be able to:

- discuss some of the early discoveries which led to the theories of Kepler and Newton
- cite additional evidence from later studies of the skies, leading to Einstein's theories
- identify most nearby heavenly bodies
- describe the different phases of the moon and explain their causes and how they relate to the Earth's tides
- explain the Earth's day/night sequence and how it relates to the Earth's movements through space
- explain the Earth's seasons, and how they relate to the Earth's movements through space
- name some of the major constellations and identify one or two important stars
- describe the importance of the sun, explain its position in the solar system, and detail some of the ways it affects Earth.

Skill Objectives

The student should also develop these specific skills upon the completion of the simulation:

- decision-making skills
  - — searching for alternatives
  - — weighing alternatives
  - — evaluating decisions

- social skills
  - — contributing to group problem-solving
  - — expressing ideas
  - — listening to others
  - — defending a point of view
  - — accepting the opinions of others
  - — reaching consensus
  - — cooperating

- research skills
  - — searching for information
  - — categorizing information
  - — record keeping

- strategy formation and implementation
  - — defining possible strategies
  - — testing strategies
  - — examining alternate strategies
  - — planning a course of action
  - — following a course of action

Decision-making and strategy formation and implementation play major roles throughout the simulation. Social skills are enhanced by group decision-making and strategy planning. Students develop their research skills while seeking solutions in the reference material and in other sources.

System Requirements

If you are using a 3.5 inch disk version of this program, or a network version, please refer directly to Appendix A, as some of the following information will not apply to you.

There are three disks in the Apple 5.25" version of this program, titled: *Astro Master*, *Astro One*, and *Astro Two*. If you are using the MS-DOS 5.25" version you will have two disks: *Astro Master* and *Astro One*. The program fits entirely on one 3.5" disk (Apple or MS-DOS), titled *Adventures in Astronomy*.

Apple versions will operate on Apple II+, IIe, IIc, and IIgs computers with 64K RAM (or more) and one or two disk drives.

MS-DOS versions of *Adventures in Astronomy* will run on any IBM PC with at least 256K RAM (or more) and one or two disk drives. The PC must be equipped with a Color Graphics Adapter (CGA) or equivalent. RAM in excess of 256K will be utilized as a RAM disk. The program will also operate on 100% IBM compatibles, including the Tandy 1000.

Loading the Program

If you are using a 3.5" disk version, or a network version, of this program, please refer to Appendix A of this manual before reading the following.

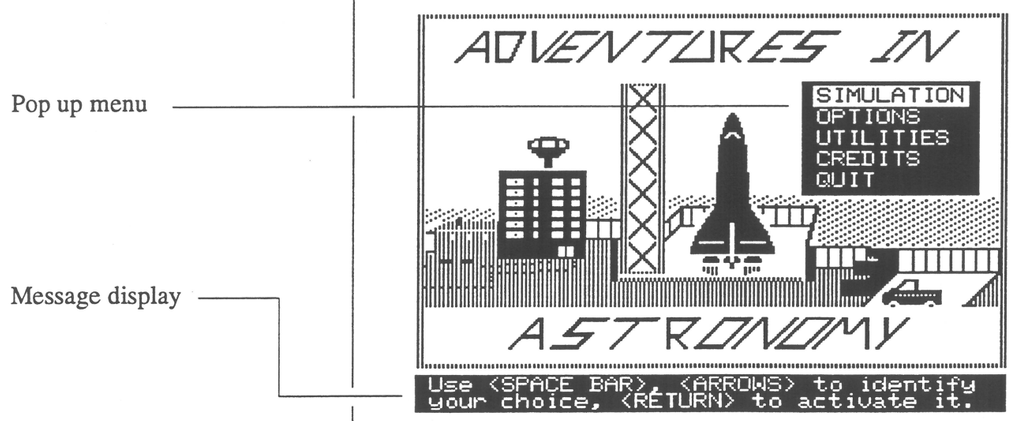
Apple

The boot (start up) disk is titled *Astro Master*. Place it in Drive One. Boot the program by turning on the computer or by pressing the appropriate keys (as shown in your Apple Owner's Manual — i.e. the <CTRL>, <RESET> and <OPEN APPLE> keys in the case of the Apple IIe) if the computer is already on.

MS-DOS

Boot the program by loading DOS 2.0 (or higher), then insert *Astro Master* and type ***ASTRO***

Diagram 1 — The Teacher Menu

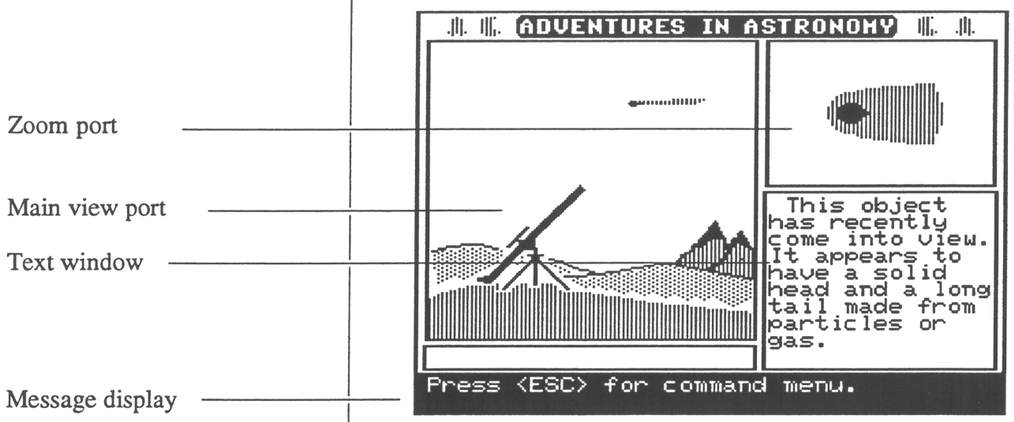


When the program is loaded, a Title Screen and Teacher Menu will appear (see Diagram 1). To begin the simulation, press <RETURN>. The computer will instruct you to remove the *Astro Master* disk and insert *Astro One*.

If you have not used the program before, you will be asked to enter your name. Type in your first and last names. Press <RETURN>. All sessions saved on this disk will be saved under your name. The Introduction Screen should now appear. Press the <SPACE BAR> to proceed to the simulation.

If you have used the program before and have saved your session, the computer will automatically load that saved session (depending on the defaults set under Option Control). If you have not saved a session, you will proceed directly to the simulation.

Diagram 2 — The Main Screen


ADVENTURES IN ASTRONOMY
This object has recently come into view. It appears to have a solid head and a long tail made from particles or gas.
Press <ESC> for command menu.
Zoom port
Main view port
Text window
Message display

Using the Program

While using *Adventures in Astronomy* you will be asked to use menus, respond to instructions, and exchange disks. You will have more success using the program if you have a complete understanding of these three functions.

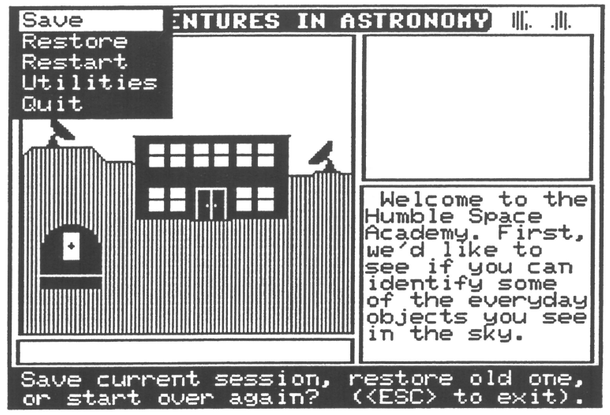
Menus

Throughout the program you will want to take advantage of the Command Menu which comprises the *Actions, Info, Quiz* and *Quit* commands.

To tell the computer what you want to do, use the <SPACE BAR> or <↔> keys to move the highlight to the desired command. For example, to select *Save* from the *Quit* submenu, first select *Quit* by moving the highlight to *Quit* and pressing <RETURN>. The *Quit* submenu will appear at the top of the screen. Now select *Save*. The menu should appear as in Diagram 3.

If at any time you wish to escape from a menu or operation, press the <ESC> key.

Diagram 3 — Selecting A Command From A Menu


Save
Restore
Restart
Utilities
Quit
ENTURES IN ASTRONOMY
Welcome to the Humble Space Academy. First, we'd like to see if you can identify some of the everyday objects you see in the sky.
Save current session, restore old one, or start over again? (<ESC> to exit).

Instructions

While using *Astronomy* you will often see instructions at the bottom of the screen. They will usually inform you of the different command options you have (i.e. "<RETURN> to continue, <ESC> quits") or reasons why the computer does not understand your command. You may be asked to press a key or insert a certain disk. Read these instructions carefully and the program will progress smoothly.

Exchanging Disks

Astronomy resides on three Apple 5.25" disks or two MS-DOS 5.25" disks: *Astro Master*, *Astro One*, and *Astro Two* (Apple II only). After choosing *Simulation* from the master disk, you will have to remove the *Master* disk and insert *Astro One*.

Apple

If you are using a computer with two disk drives, exchange *Astro One* for *Astro Master* in drive one and insert *Astro Two* in drive two. You will not have to exchange disks again unless you wish to use the utilities on *Astro Master*.

If you are using a computer with one disk drive, exchange *Astro One* for *Astro Master* in drive one. You will be prompted when to exchange *Astro One* for *Astro Two*. (This will happen whenever you access the *Quiz* or *Reference* files.)

PC:

Exchange the two disks when requested. If you have two drives, you may insert *Astro One* in drive two and will not have to exchange disks at all.

Hard disk installation

Note: the 5.25" version of the program should not be loaded onto a hard disk. If you require the program to be loaded onto a hard disk, for single or multi-terminal use, please contact Entrex directly.

Main Screen Components

The main screen (see Diagram 2) is divided into several sections: the main view port, a zoom port, a text window, and the message display.

Main View Port

The main view port will display whatever you are currently looking at. This will include the solar system, the Earth, tides, etc. It will also display each award you receive, when you receive it.

Zoom Port

The zoom port provides a close up look at different objects, and in some cases may show diagrams to help explain what is displayed in the main view port.

Text Window

Below the zoom port is the text window. Generally, the text will describe the view in either of the two view ports. It may also provide hints as to what action should be taken next.

The text window will sometimes display text which describes events which have happened not as a direct reaction to your actions, but due to some other factor. These events will usually be negative (such as running out of fuel, colliding with a meteorite, etc.).

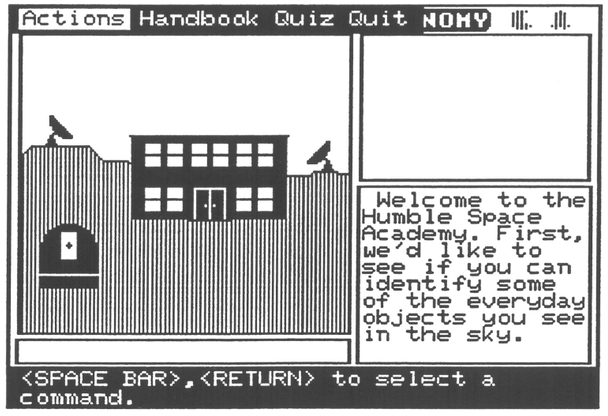
Message Display

The message display bar, at the bottom of the screen, provides information as to what you should do next, how to select a command, and so on.

Commands

This section provides a detailed explanation of each of the commands available from the Command Menu.

Diagram 4 — The Command Menu


Actions Handbook Quiz Quit NOMY
Welcome to the Humble Space Academy. First, we'd like to see if you can identify some of the everyday objects you see in the sky.
<SPACE BAR>,<RETURN> to select a command.

Actions

Actions leads to a list of possible actions (a partial list follows). Responses to the action will be depicted graphically, in the graphics window, and in the text window. Not all the commands will be available at any one time.

Take quiz — Choose this command to start your personal entrance quiz. You must pass the quiz to be allowed into the Space Academy.

Examine — This command allows you to zoom in on an object. A close up picture will appear in the zoom port.

Identify object — When you are sure you know the name of the object you are looking at, choose this command, then select the object's name from the list.

Move scope — Use this command to aim the telescope at a different part of the sky.

Avoid ID — Use this command to avoid making an identification of an object. This will allow you to examine the object, or to move the scope.

Increase/Decrease thrust — Use these commands to increase or decrease the amount of power used to blast off.

Increase/Decrease angle — Use these commands to adjust your trajectory. Increasing the angle will widen your orbit, while decreasing the angle will narrow your orbit.

Start orbit — Use this command to start the objects in the main view port in motion. Usually a *Start Orbit* command should be followed by a key press to fire rockets. Watch the objects move, when each is in the right position, press <RETURN> to fire your rockets.

Select target — Use this command when you are ready to locate an object (usually from a group of objects in a constellation). A targeting box will appear on your screen. Use your <↔> keys to move the box over top of the target.

Locate ship — Use this command when you are ready to locate a lost or damaged ship. A cross hair will appear on your screen. Use your <↔> keys to move the cross hair to the appropriate location.

Quit Tour — Use this command to quit your tour of the solar system only if you are sure you will be unable to complete the tour on your own (i.e. if you are about to run out of fuel; or worse yet, if you have run out of computer time).

Handbook

This option presents, in encyclopedia fashion, information concerning different aspects of astronomy. Use the <SPACE BAR> and <↔> keys to select a topic, then press <RETURN>. Press <RETURN> to select another topic or press the <ESC> key to return to the simulation.

Diagram 5 — Reference

```
                *** TOPICS ***
HEAVENLY BODIES              Leo
   Stars                     Libra
   Planets                   Pisces
   Asteroids                 Sagittarius
   Comets                    Scorpius
   Meteors                   Taurus
   Satellites                Virgo
THE SUN                   ABOUT PLANETS
THE MOON                     Tides
ON THE MOON                  Seasons
PHASES                       Eclipses
GRAVITY                   TIME OF DAY
ORBITS                    MERCURY
CONSTELLATIONS            VENUS

<ARROWS, SPACE BAR> for other CHOICES and
<RETURN> to read, or <ESC> to exit.
```

Quiz

Choose this option when you wish to take a multiple choice quiz based on the information contained in the program. You may take the quiz as often as you wish to improve your score (depending on how options are set on the Master disk).

The quiz comprises between 1 to 20 questions chosen from a pool of 50 questions (the number of questions is set using the *Set Quiz Values* utility, described in part 2).

A good strategy is to use the quiz as a pre-test and a post-test. Take the quiz before using the simulation and reading the reference material, and once again when you have finished the simulation. The results should indicate how well you have learned the information in the program.

Quit

Leads to a submenu of five items: *Save, Restore, Restart, Utilities* and *Quit.*

Save

You may save a session if you wish to finish it later. After selecting this option, you will be asked to enter a name to identify the session. (NOTE: If you do not save your session, no record of it will be kept.) All sessions are saved on *Astro One*. Three sessions may be saved for each user. You may erase any of the sessions and save as often as you like.

Restore

Resume a previously saved session with this option. The names of all saved sessions on your disk will be displayed. Type <RETURN> to restore the session highlighted or use the <←→> keys to select a different session. Press <ESC> to return to the main screen without restoring.

When loading the simulation from the Master disk, the computer will automatically load the most recently saved session, if one exists (depending on the setting of certain options). If you do not wish to resume this saved session, choose *Restart* (see below).

Restart

This option allows you to start the simulation over. All previous actions and events will be erased, though sessions saved to disk will not be affected.

Utilities

Use this option to go to the Options and Utilities menus on the *Astro Master* disk. *Be sure to save your session before loading Utilities.* Insert the Master disk and press <RETURN>. Press <ESC> to return to the simulation.

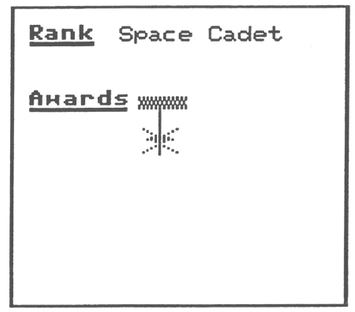
Quit

Use this option if you are finished for the day. (NOTE: *Quit* does not automatically save your session.)

Earning Your Promotions

To enter the Space Academy, you must first correctly identify five out of eight objects commonly seen in the sky. This earns you the opening rank of Space Cadet.

As a space cadet, you will have three main tasks to complete. You will have to successfully attain earth orbit in your space ship, you will have to land on the moon, and you will have to complete a lunar gravity experiment. You will be promoted to Junior Officer when you return to earth.



As a junior officer, you have three more tasks to attend to. You must operate a space communications desk, you must lead a rocket recovery operation, and you must assist in two spaceship rescue missions. Once you have completed these tasks you will be promoted to Shuttle Pilot.

Further promotions are available for successfully ferrying scientists to and from bases on Jupiter. Finally, to win your Astrogator's wings, you must complete a tour of the solar system without running out of fuel.

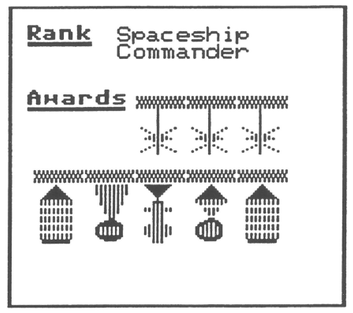
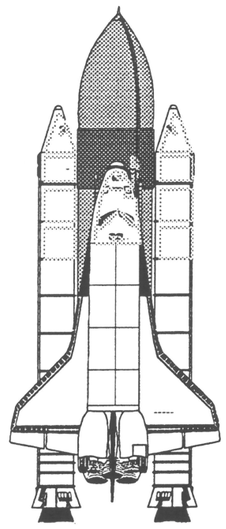
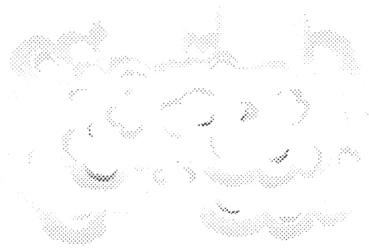


Figure 1 — Space Shuttle circa 1988





Part Two

Teacher Options and Utilities

Setting the Options

You may wish to change factors within the program to make it suit the computer hardware you are using or to streamline the *Quiz*. This can be achieved by changing one or more of the program Options. To make these changes use the <SPACE BAR> to highlight *Options* at the Teacher Menu. Press <RETURN>. This screen will appear:

Diagram 6 — Options Screen

```
***   CONTROL OF OPTIONAL FEATURES   ***

A.    Quick Boot:                     on
B.    Autorestore Last Session:       on
C.    Query on Autorestore:          off

D.    Color Monitor                  off
E.    Sound:                          on
F.    Quiz:                           on

G.    Action Menu:                    on
H.    Reference:                      on
I.    Delay Duration Level             3

Press a letter to change a setting.
Press <ESC> to leave as was; or press
<RETURN> to use the settings shown.
```

If you decide to leave the options unchanged, press the <ESC> key. If you want to change an option, type the corresponding letter. For example, to turn *Sound* off, press <E>. Press <E> again to turn *Sound* on.

After you have selected your option settings, press <RETURN> to return to the Teacher Menu.

Here is what happens when each option is turned on.

Quick Boot

This option enables you to save time booting the program. With *Quick Boot* turned on, each time you boot *Astro Master* you will be able to proceed directly to the simulation and bypass the Teacher Menu.

Autorestore Last Session

With this option turned on, the simulation will automatically restore the last session saved, allowing work to continue from that point. Like *Quick Boot* this is especially useful in a lab situation where each student has a copy of the program.

Query on Autorestore

This option allows students to decide, when starting up the simulation, if they wish to continue a previous session or start anew. The program will proceed to the *Restore* screen and highlight the last session saved. Type <RETURN> to restore the session or <ESC> to start the simulation again.

Color Monitor

If you are using computers with color monitors or are using an Apple IIgs, this option should be set to "On." If you are using monochrome monitors, set this option to "Off."

Sound

The program uses sound to indicate when it does not understand a command or action or to signify the occurrence of a special event. In a room with many computers the sound can become annoying. Turn the *Sound* option off to avoid this problem.

Quiz

Included on *Astro Two* are 50 multiple choice questions. These questions may be assigned as a pre-test, a post-test, or both. The Quiz may be taken as many times as allowed by the teacher. Turn this option on if you want your students to take the Quiz, turn it off if you would prefer them to concentrate on the simulation.

Reference

A reference section may be used to help students find solutions to the experiments and prepare for the quiz. You might consider turning this option off if you have printed out the material and given it to the students, or if you want to create a "closed-book" quiz.

Delay Duration Level

The Delay Duration Level (DDL) adjusts prompt delay/response time. Settings range from 1 to 5, where 1 is very quick and 5 is very slow. People using turbo cards or the Apple IIgs may want to slow the DDL so they don't miss any important prompts. The DDL does not affect basic processing speeds.

Record Keeping

Record keeping is one of five utilities included with the program, and is divided into two sections: individual data and group data. Individual data allows you to evaluate an individual's performance, while group data allows you to compare an individual's performance against members of a larger group.

Diagram 7 — Utilities

```
***            UTILITIES            ***

1.      Record Keeping
2.      Configure Printer
3.      Print Files
4.      Modify Questions
5.      Set Quiz Controls



Note:  if the Printer Configuration is
not accurate then print options may
not perform as expected.

Press <1..6> to choose utility.
<ESC> to exit back to main menu.
```

Individual Data

Choose this option to view data saved on each student disk. The information provided will give a quick insight into the student's progress, including quiz scores and assignments completed within the simulation.

Press <RETURN> to look at a second data disk. The computer will prompt you to insert the next data disk, then press <RETURN>.

If you wish to compare the scores achieved by different students, type <A> to add the individual data to a group (or class) record. Using the *Group Data* option, you will then be able to compare all students whose data has been saved to the group record. Up to 50 students' data may be saved to the group record (stored on the Master disk).

Group Data Warning

WARNING! only the student's scores are saved to the group record, not the student's actions. Transferring the data is NOT the equivalent of maintaining a copy of the individual data.

Diagram 8 — Individual Data

```
***     SESSION & QUIZ RESULTS   ***

Name: JORDAN
Quizzes saved, most recent first:
    Right  Wrong Avoided Score    Out Of
1     6      4       0      6       10
2     4      5       1      4       10

Last session saved:
Level: Junior Officer

Commands:       6      Actions     14
Coffeebreaks           2 hours

Press  <ESC> for menu
  <RETURN> to show NEXT individual.
  <A> to ADD individual to group.
  <E> to ERASE individual data.
```


Press <E> to erase the individual data from the data disk. You will be presented with three options. Press <Q> to erase quiz results only; press <S> to erase saved sessions; or press <A> to erase both quiz results and saved sessions, thus preparing the disk for a new student. If you wish to keep track of student scores be sure you have added them to the group record.

Press <ESC> to return to the Introductory Screen.

Group Data

Choose this utility if you wish to view all data saved to the group record (using the *Individual Data* utility). Up to 15 students' records will be displayed on the screen at one time, including name, most recent score on the quiz (if any), and current score in the simulation (the level they are currently working at).

Type <RETURN> to see more students' records (if you have saved more than 15 to the group record) or to repeat the listing.

Type <E> to erase the group record. Do this only if you want to start a new group record and are sure you have no further use for the current one. It is a good idea to print out the group record before erasing it.

Type <P> to print out the group record (be sure your printer is properly configured).

NOTE: when a question mark (?) appears before any Quiz score, the computer has found a score which is based on different option settings than the first test score in the file (see Set Quiz Controls for information on quiz options).

Type <ESC> to return to the Introductory screen.

Configure Printer

Use this utility to configure your printer to this program. This needs to be done only once as all settings are saved. If the printer is improperly configured some printouts may stretch over page breaks or may not print out at all. The default settings provided in the program should be adequate for most printers (see Diagram 10).

Form length: The standard form length for 8.5 x 11 inch paper is 66, or six lines per inch.

Diagram 9 — Configure Printer

```
PRINTER CONFIGURATION

66.     1. Form length (lines).
80      2. Form width (characters).

 0      3. Left margin (characters).
 0      4. Right margin (characters).
 0      5. Top margin (characters).
 0      6. Bottom margin (characters).

 Y      7. Line feed after C/R.
 Y      8. Form feeds.
 N      9. Pause at end of form.
 1      0. Hardware slot.


Press 1..6 to select item to configure.
<RETURN> saves configuration to disk.
<T> for temporary use of configuration.
<ESC> to keep the old configuration.
```

Form width: The standard form width for 8.5 x 11 inch paper is 80 characters.

Left margin: Set the number of characters you wish to indent text from the left margin. Default setting is 0.

Right margin: Set the number of characters you wish to indent text from the right margin. Default setting is 0.

Top margin: Set the margin at the top of each page by indicating the number of blank lines you wish to appear before the first line of text. Default setting is 5.

Bottom margin: Set the margin at the bottom of each page by indicating the number of blank lines you wish to appear after the last line of text. Default setting is 5.

Note: the above six settings should not be changed unless there is some specialized custom printing you wish to do—centering, using odd-sized paper, etc.

Line feed after C/R: Check your printer and printer card manuals about this option. Some printers automatically insert a line feed after each carriage return; other printers require the software to instruct it to perform a line feed.

Form feeds: Check your printer and printer card manuals before adjusting this option. Some printers automatically insert a form feed after printing either 54 or 55 lines. If your printer does not automatically insert a form feed, turn this option on.

Pause at end of form: If you are printing onto single sheets of paper, turn this option on.

Hardware slot: (Apple users only) Your printer card must be in slot 1 or slot 2.

Print Files

Choosing this utility will allow you to print copies of the *Reference* and *Quiz* files.

To print the files, use the <←→> keys to select the appropriate file. Then choose either <1> or <2> for 40 or 80 column print. Press <ESC> to return to the Print Files menu.

If you choose to print the *Reference* files, a list of the topics will be displayed. Type the number of the topic you wish to print, or type <A> to print all the topics. <ESC> will return you to the Print Files menu.

If you choose to print the *Quiz* you will be given five options.

Set Question/Answer Order

This option allows you to change the order of the questions to discourage cheating during the quiz. To change the order, simply type the number of the question you wish to appear first on the quiz. The computer will automatically scramble the following questions in an order predetermined by which question is printed first.

You may also change the order in which the answers appear with the questions. On one version of the quiz you may wish to have the answers appear in the same order as they are stored on disk, i.e. 1,2,3,4. On a second version of the quiz, you may choose to print the answers in a different order, i.e. 2,4,1,3. In this second case, the second answer will be printed first, the fourth will be printed second, etc. All questions will follow this pattern.

Set Master/Quiz Option: Quiz

This option allows you to decide whether or not to print the questions with the correct answers identified, as for a master, or without the correct answers identified, as for a quiz. You may want to print out several different quizzes, using the *Set Question/Answer Order* option, and then photocopy them.

Set Numbering Option: Print-out

Use this option to adjust the manner in which the questions will be numbered when they are printed. If the option is set to "Print-out," then the questions will be numbered sequentially, i.e. 1,2,3,...

Diagram 11 — Printing Questions

```
***    PRINT QUESTIONS UTILITY        ***

1.  Set Question/Answer Order:    1/1234
2.  Set Master/Test Option:          test
3.  Set Numbering Option:      print-out

4.  Type Header.
5.  Print Questions




Press <1..5> for an action menu.
Press <ESC> for main menu.
```


If the option is set to "File" the questions will be numbered according to the sequence they are stored on disk regardless of the order in which they are printed out. This is a useful way of numbering the questions if you will be making up several versions of the same quiz, but will want to refer to questions by their number.

Type Header

This option gives you three lines at the top of the page to write instructions, point values, or anything else you want to appear at the top of the quiz.

The old header will be displayed at the top of the screen. Because the screen's text display is in 40 columns, each of the three lines available for use in the printed header is displayed on screen as two lines. Type in the new header where the flashing cursor is, about half way down the screen. Remember, each line on the screen is only one-half of a line on paper.

NOTE: do not press <RETURN> at the end of each line. Use the <SPACE BAR> to move the cursor to the next line.

Print Questions

Choose this option when you are ready to print out the quiz. The computer will prompt you to insert *Astro Two*. After you have exchanged the disks, press <RETURN> to print (be sure your printer is properly configured!) or <ESC> to avoid printing.

You may halt the printing at any time by pressing the <ESC> key and holding it down until the printer stops. This may take a moment, as the printer will always finish the question it is printing before it responds to your command.

Modify Questions

You may change any of the questions appearing during the simulation. You may also create additional disks with new questions.

Keep in mind that the questions are contained on *Astro Two*. If you change questions on one disk and want all of the students to have them, you will have to make copies of the disk you changed. Instead, you may want to create several different disks and circulate them among the students for an endless array of questions.

NOTE: It is not a good idea to change questions on the original *Astro Two*. Only make changes to copies of that disk.

To edit or replace old questions with new ones, use the <SPACE BAR> to highlight the *Utilities* category at the Introductory Screen and press <RETURN>.

Choose <5> when the Utilities Screen appears. The computer will instruct you to insert *Astro Two* and press <RETURN>. A screen similar to this will appear:

Diagram 11 — Modify Questions

```
    *          MODIFY QUESTIONS              *
#3 of 50


           Which planet is often
           thought of as a twin
           to Earth?
              X  Mars
              X  Neptune
              *  Venus
              X  Saturn



Press <E> to edit, <N> to see next
question, <P> to see previous question.
<ESC> for main menu.
```

Press <E> if you wish to edit the question. The cursor will appear on the first letter of the question. Use the <↔> keys to move it to the portion of the question you wish to change. Type in the changes over the old information.

If you wish to write a new question, leave the cursor at the beginning of the question and simply type the new question over the old.

When editing and writing questions, keep these points in mind:

- Each question must contain three lines. You cannot reduce the question's length to two or increase it to four.
- Question lines may contain up to 27 characters (including blanks).
- There must be four answer choices to each question, with one choice to a line.
- Only one answer to a question can be correct. Precede the correct answer with an asterisk "*".
- Incorrect answers must be preceded by a capital "X".
- Before typing an answer, skip two spaces, type <*> or <X> for correct or incorrect, and then skip one more space before typing in the answer. You may use up to 23 characters for each answer.

NOTE: If you do not follow the correct procedure for writing questions, the computer will give you an error message and will not allow you to save the modified question.

When you have finished editing a question, press the <CONTROL> and <C> keys simultaneously. The computer will ask you if you wish to save the new question. Type <Y> to save the changes or <N> if you have changed your mind.

To move to the next question, type <N>. To move to a previous question, type <P>.

When you have finished editing, press <ESC>. If you are using one drive, reinsert *Astro Master* and press <RETURN> to return to the Introductory Screen.

Set Quiz Controls

Use this option to set the number of quizzes a student may take, the number of questions to be answered, and the number of points to be awarded or deducted for each question answered correctly, incorrectly, or not answered at all. The contents of each quiz can also be controlled.

Press <1...9> to change the setting of an item, then press <RETURN> to save the new settings. Press <ESC> to restore the original settings.

Number of quizzes — may be set from 1 to 10. Each quiz will have different questions, as the questions are chosen randomly from a pool of 50.

Number of questions — (per quiz) may be set from 1 to 20.

Correct answer — set the points awarded for each correct answer (from 1 to 20).

Wrong answer — set the points deducted for each wrong answer (from -10 to 0).

Answer avoided — set the points deducted for avoiding a question (from -10 to 0).

Random/seq. questions — choose whether you wish the questions in the quiz to follow a preset sequence or to appear randomly.

First question — (if sequential) if you have chosen to have the quiz questions appear sequentially, choose which question you wish to appear first, the rest of the questions will follow in sequence.

Successive quizzes to be the same — if you wish each quiz to be the same, set this option to "yes"; if you wish different questions to appear in the quiz each time it is selected, set this option to "no."

Reference — this option can be used to restrict access to the reference material; set it to "off" if you wish the quiz to be "closed book" style, or to "on" if you wish the quiz to be "open book."

Part Three

Using the Program in the Classroom

Introducing the Program to Students

This program works most effectively when used in conjunction with a complete unit of study focusing on astronomy. It can also be used on its own, or as enrichment or supplementary material. It is geared towards science and astronomy classes in the grades 4 to 8 range. The reading level of the background material is rated at 6/7 (exclusive of technical terms).

Whatever strategy you choose, some introductory work will be required to ensure the most effective use of the simulation on the computers.

First, initiate a class discussion on basic astronomy. Why did the ancients bother to study it? How does astronomy help us measure time and seasons? Discuss the planets, their names, other heavenly bodies in the solar system, and constellations. Aside from time issues, ask students if they can think of other ways the study of astronomy can help us understand our own world. A fifteen minute discussion should generate some good ideas.

Now introduce the aims and objectives of *Adventures in Astronomy*. Explain that the program is meant to be a fun, role playing game, where successful "astronauts" will learn to fly spaceships all over the solar system. Along the way they will rescue stray rockets, work at a space station communications center, and ferry scientists between planets.

Lesson Plans

The following study unit could span two to five 50 minute classes, depending on the depth of learning desired. The simulation itself can be completed in two classes.

DAY 1

Discuss the earth as a heavenly body. In what ways does the earth move? Where does it fit in our solar system? What is a solar system and how does it relate to galaxies and universes?
Assignment 1: *Using 10 balls (of differing size and color, if possible) ask students to construct a simple model of our solar system. See if they can demonstrate the rotation and orbit of Earth.*

DAY 2

Discuss the moon and its relationship with Earth. How big is it? How close is it? How does it differ from Earth (gravity, atmosphere, life...)? How is it similar?
Assignment 2: *Using the model developed in assignment 1, introduce an eleventh ball to represent the moon. Can your students now simulation the motions of both the moon and Earth?*

DAY 3

Introduce the aims and objectives of *Adventures in Astronomy*. Give a short demonstration of the program, identifying one or two objects in the sky so your students can see how to get started. Have students take the *Quiz* and save the results under their name.
Assignment 3: *Continue your discussion on the moon. Introduce the phases of the moon and how the moon causes tides on Earth. Ask your students to look for the moon at night and to try to identify the phase it is in.*

DAY 4

Continue with *Adventures in Astronomy*. Encourage students to read the reference material if they are unsure of how to proceed. Ask students to save their sessions before the end of class.
Assignment 4: *Ask students to draw a diagram of the solar system, identifying each planet by name, size and position from the sun.*

DAY 5

Ask students to complete their work with the simulation (if they haven't already done so) and then retake the Quiz. Be sure to ask them to save their sessions before the end of class.
Assignment 5: *Ask your students to write a short report explaining time and seasons in terms of the movement of the Earth. Offer bonus points if they can explain how lunar and solar eclipses are caused by the movements of the Earth and the moon.*

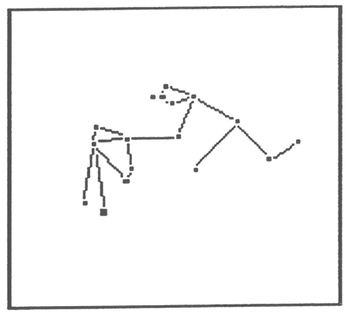
Other Activities

Additional activities could include:

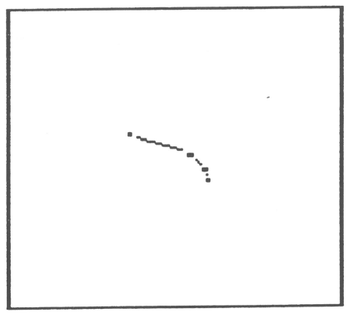
- discuss constellations—what are the major constellations, how far away are they, what are their names, how did people come up with these names?
- discuss gravity and its role in determining the motion of planets. Who first defined gravity? What 20th century scientist redefined the laws of motion?
- ask students to write a short history on the development of astronomy as a science. Why did the ancients study the stars? What was Copernicus's contribution? Kepler's? Newton's?

Star Charts

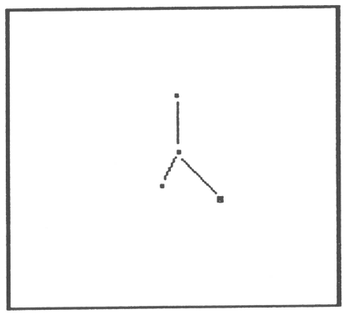
Aquarius



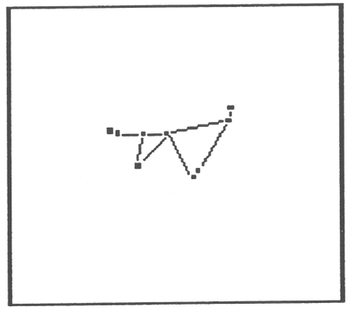
Aries



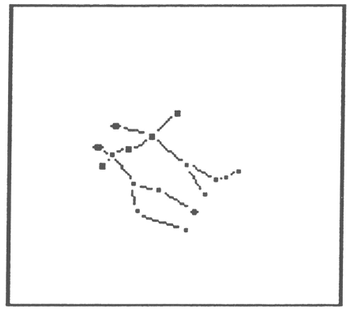
Cancer



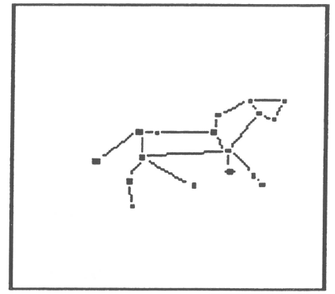
Capricorn



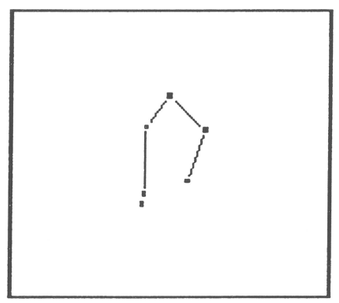
Gemini



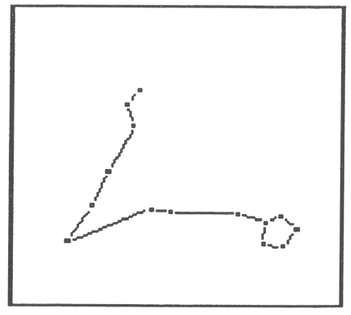
Leo



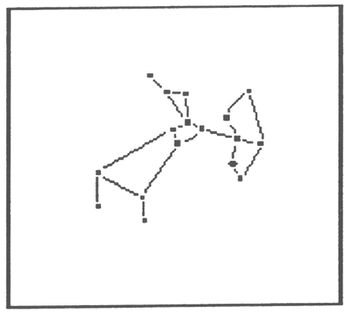
Libra



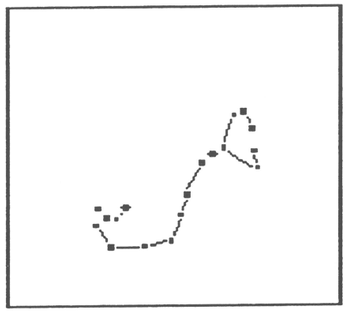
Pisces



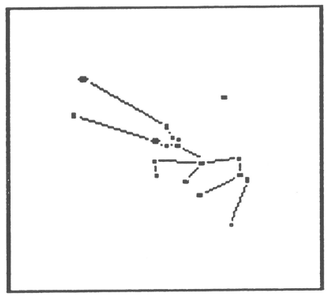
Sagittarius



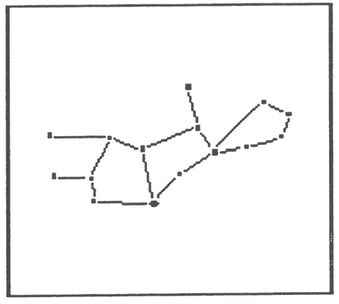
Scorpio



Taurus



Virgo



Part Four

Worksheets

Glossary

Aquarius	the Water Bearer, a constellation in the zodiac.
Aries	the Ram, a constellation in the zodiac.
asteroid	a small (compared to planets), rocky or metallic heavenly body, irregular in shape.
astronaut	a space traveller.
astronomer	one who studies astronomy.
astronomy	the study of the heavenly bodies.
axis	a line around which a turning body rotates.
big bang	a theory which states the universe started with a large explosion.
Brahe, Tycho	a Danish astronomer who was able to measure the length of a year to within one second.
Cancer	the Crab, a constellation in the zodiac.
Capricorn	the Sea Goat, a constellation in the zodiac.
comet	a heavenly body made mostly of ice and rock which travels around the sun in a greatly stretched orbit.
Copernicus, Nicholas	a Polish astronomer who developed the first model of the solar system which showed the sun at its center, with Earth orbiting the sun.

corona	the halo of gases surrounding the sun; visible during an eclipse.
counterclockwise	opposite to the direction the hands on a clock move; from right to left.
crater	a bowl-shaped depression, at the outlet of a volcano, or caused by an explosion or by the impact of a large, heavy object.
crescent	shaped like the moon in its first or third quarter; having one concave edge and one convex edge.
day	the period of time from one "noon" to the next; on earth, 24 hours.
Earth	third planet from the sun; the only one known to support life.
eccentric	not in the form of a perfect circle, more like a stretched oval.
eclipse	the dimming of light from one heavenly body by another.
Einstein, Albert	20th century scientist who discovered general relativity.
first quarter	a phase of the moon, where the right half is lit by light from the sun.
full (phase)	a phase of the moon, where the entire moon is lit by light from the sun.
fusion	a thermonuclear reaction in which the nuclei of a light element are transformed into those of a heavier element, releasing huge amounts of energy.
Galilei, Galileo	an astronomer and physicist; founder of the science of dynamics, a supporter of Copernicus's ideas.
Gemini	the Twins, a constellation in the zodiac.
general relativity	a theory proposed by Einstein which improves on Newton's laws of motions.
gravity	the attractive force between two objects; directly related to the mass of the objects and inversely proportional to the distance between them.
Jupiter	the fifth planet from the sun, and largest in our solar system.
Kepler, Johannes	a German astronomer who formulated laws for planetary motion.
Leo	the Lion, a constellation in the zodiac.

Libra	the Scales, a constellation in the zodiac.
maria	lunar "seas;" actually great, waterless plains (mare is Latin for sea).
Mars	fourth planet from the sun, sometimes called the "Red" Planet.
mass	that property of an object that causes it to have weight in a gravitational field; sometimes taken to be a measure of the amount of material in the object.
Mercury	first planet from the sun and second smallest in the solar system.
meteor	a small piece of rock or metal which falls into Earth's atmosphere.
meteor shower	a number of meteors, also called shooting (or falling) stars.
meteorite	a meteor that manages to reach the ground before it burns up.
Neptune	usually the eighth planet from the sun, though currently the ninth because of Pluto's eccentric orbit.
new (phase)	a phase of the moon when none of the moon's surface is lit by the sun.
Newton, Sir Isaac	the English philosopher and mathematician who formulated the laws of gravitation and motion.
nova	a star that suddenly flares up then slowly disappears after a few weeks or months.
nuclei	plural of nucleus; the center part of an atom.
orbit	the circular path one heavenly body follows in revolving around a second body.
phase	the aspect (or the appearance) of the moon or a planet.
Pisces	the Fishes, a constellation in the zodiac.
Pluto	usually the ninth planet from the sun, though its eccentric orbit sometimes moves it closer to the sun than Neptune; smallest planet in the solar system.
rotation	the spinning of the Earth around its axis.
rotation period	the length of time it takes the Earth to complete one spin around its axis; just less than a day.

Sagittarius	the Archer, a constellation in the zodiac.
satellite	a manmade object launched into orbit around the Earth.
Saturn	sixth planet from the sun; second largest in the solar system and best known for its rings.
Scorpio	the Scorpion, a constellation in the zodiac.
season	the climatic effects produced each year by the changing tilt of the earth in relation to the sun.
solar flare	a short, sudden outburst of energy from a small area of the sun's surface.
solar prominence	a flamelike loop made of gases which rise above the surface of the sun.
sunspot	a dark spot on the sun's surface, usually cooler than adjoining areas.
Taurus	the Bull, a constellation in the zodiac.
third quarter	a phase of the moon where the left half is entirely lit by light from the sun.
tide	the periodic rise and fall of ocean waters due to the gravitational attractions of the moon and the sun.
Uranus	seventh planet from the sun; surrounded by 10 main rings; unique because of an 82 degree tilt to its axis.
Venus	Earth's twin, second planet from the sun.
Virgo	the Virgin, a constellation in the zodiac.
waning crescent	a phase where only the extreme left side of the moon is lit .
waning gibbous	a phase of the moon where the leftmost three-quarters is lit.
waxing crescent	a phase where only the extreme right side of the moon is lit.
waxing gibbous	a phase of the moon where the rightmost three-quarters is lit.
year	the period of time in which the Earth completes one full revolution around the sun.
zodiac	an imaginary belt in the heavens which follows the path of the sun and is divided into twelve sections.

Assignment Questions

1. Name each of the nine planets in our solar system. Can you identify them in terms of their distance from the sun?

2. Which heavenly body is closest to the Earth? How big is it? How close is it?

3. Approximately how long does it take the moon to circle the Earth?

4. When the moon circles the Earth, it goes through eight phases. Can you name those phases in the order in which they occur?

5. Describe an ocean tide; include in your description a sentence or two explaining what causes tides.

6. Which units of time are based on the movements of heavenly bodies? Which units are purely manmade?

7. How are seasons a result of the movement of the Earth around the sun?

8. What is the proper name for the event that occurs when the moon passes between the sun and Earth, temporarily casting its shadow on Earth? What is the name for the event that occurs when the Earth passes between the sun and the moon, temporarily casting its shadow on the moon?

9. What is the zodiac? Where would you look for it? Can you name its twelve components?

10. What is gravity? Who first defined its properties? What role does gravity play in determining the movements of heavenly bodies?

11. Match the following people to the astronomy related discoveries and theories they are best known for:

Johannes Kepler	measurement of the length of the year
Isaac Newton	three laws of planetary motion
Tycho Brahe	the first to study the stars with a telescope
Nicholas Copernicus	the law of universal gravitation
Galileo Galilei	the theory that the sun was at the solar systems's center

12. What is an asteroid? A comet? A meteor? How are these three objects different? How are they similar?

13. What is the difference between a meteor and a meteorite?

14. What is the sun made up of? Does it have continents and oceans like Earth?

15. Does the sun revolve around the Earth or does the Earth revolve around the sun? Does the sun rotate on its axis?

Adventures in Astronomy

Multiple Choice Quiz

Read each question carefully and then study each of the possible answers. Circle the letter beside the *best possible* answer.

1. **Astronomy would best be defined as the study of:**
   a. the things we see in the sky
   b. planets and stars
   c. tides, eclipses and seasons
   d. the history of the universe

2. **A group of stars which seem to form a picture are called a:**
   a. solar system
   b. galaxy
   c. zodiac
   d. constellation

3. **Which of the following is NOT one of the nine planets in our solar system?**
   a. Pluto
   b. Mercury
   c. Venus
   d. Sagittarius

4. **These objects are smaller than planets, they are made of rock and/or metal, and are sometimes called minor planets. They are:**
   a. comets
   b. asteroids
   c. moons
   d. meteorites

5. **Which of the following heavenly bodies lies at the center of our solar system?**
   a. the moon
   b. the Earth
   c. the sun
   d. Alpha Centauri

6. **Who was the first astronaut to walk on the moon?**
   a. Edwin "Buzz" Aldrin Jr.
   b. Allan Bean
   c. Neil Armstrong
   d. Alan B. Shepard Jr.

7. **If you weigh 120 pounds (54 kg) on Earth, about how much would you weigh on the moon?**
   a. 5 pounds (2 kg)
   b. 20 pounds (9 kg)
   c. 120 pounds (54 kg)
   d. 350 pounds (156 kg)

8. **The moon passes through eight phases as it circles the Earth. What is the name of the fourth phase, when the moon is completely lit?**
   a. full moon
   b. waxing gibbous
   c. waning gibbous
   d. new moon

9. **What is the name of the force exerted between two objects which increases with the mass of the objects and decreases proportionally with the square of the distance between them?**
   a. acceleration
   b. gravity
   c. torsion
   d. kinetic energy

10. **What is the proper name for the oval path a planet traces as it circles the sun?**
    a. eclipse
    b. trajectory
    c. orbit
    d. glide slope

11. **Which of the following is NOT one of the constellations in the zodiac?**
    a. Venus
    b. Aries
    c. Capricorn
    d. Scorpio

12. **Which heavenly body is the primary cause of the tides in Earth's oceans?**
    a. the sun
    b. Mars
    c. Venus
    d. the moon

13. **Which of the following is primarily responsible for seasonal changes in climate and meteorology on Earth?**
    a. the tilt on Earth's axis
    b. the phases of the moon
    c. the Earth's spin around its axis
    d. Earth's oval orbit; sometimes the Earth is further from the sun than other times

14. **When the moon passes between the Earth and the sun, it is called:**
    a. a lunar eclipse
    b. a solar eclipse
    c. a lunar prominence
    d. a solar prominence

15. **The time it takes the Earth to complete one full spin around its axis is called:**
    a. one day
    b. one month
    c. one year
    d. one rotation period

16. **Which planet is the smallest in the solar system and usually the furthest from the sun?**
    a. Mercury
    b. Mars
    c. Neptune
    d. Pluto

17. **Which planet is the hottest in the solar system, and is also known as "Earth's twin?"**
    a. Mercury
    b. Venus
    c. Mars
    d. Uranus

18. **Which planet was the second last to be discovered, even though it is presently the ninth (and furthest) from the sun?**
    a. Jupiter
    b. Uranus
    c. Neptune
    d. Pluto

19. **Which planet lies fourth out from the sun and is sometimes called the "Red" planet?**
    a. Earth
    b. Mars
    c. Saturn
    d. Neptune

20. **Which heavenly body is both the largest and the warmest in our solar system?**
    a. the sun
    b. Venus
    c. Saturn
    d. Jupiter

21. **Which heavenly body is third largest in the solar system and is surrounded by rings?**
    a. Venus
    b. Jupiter
    c. Saturn
    d. Uranus

22. **Which group of ancient peoples advanced the furthest in their study of the stars?**
    a. the Chinese
    b. the Maya
    c. the Egyptians
    d. the Greeks

23. **Which of the following units of time was derived directly from the movement of a heavenly body?**
    a. the second
    b. the minute
    c. the hour
    d. the day

24. **Who is best known for his book *De Revolutionibus*, which presented the theory that the Earth was NOT at the center of the solar system—instead placing the sun at its center?**
    a. Johannes Kepler
    b. Nicholas Copernicus
    c. Isaac Newton
    d. Albert Einstein

25. **Publisher of *Principia Mathematica*, this man is famous for his three laws of motion and his law of universal gravitation. He is:**
    a. Albert Einstein
    b. Isaac Newton
    c. Nicholas Copernicus
    d. Tycho Brahe

Test Answers

1.	a	10.	c	18.	c
2.	d	11.	a	19.	b
3.	d	12.	d	20.	a
4.	b	13.	a	21.	c
5.	c	14.	b	22.	d
6.	c	15.	d	23.	d
7.	b	16.	d	24.	b
8.	a	17.	b	25.	b
9.	b				

The Solution to *Adventures in Astronomy*

1. To pass the entrance exam, you must correctly identify at least five of the eight objects shown.

2. To achieve Earth orbit, you should increase your thrust four times, then blast off. To adjust your orbital path, increase your angle once.

3. To land on the moon during the right phase, wait until the moon has entered the new phase, then, when your moon shuttle is passing over Antarctica, at exactly the moment you move from night into day, fire your rockets.

4. To rescue the slippers, jump!

5. To achieve lunar orbit, increase your thrust just once, the blast off. Adjust your orbit path by widening your angle once.

6. Their are many ways to return to Earth before lunch time. Probably the easiest is to wait until the Earth is just south of three o'clock and your shuttle is passing over top of the moon. Fire your rockets when your shuttle is at exactly twelve o'clock with respect to the moon.

7. You must correctly target at least three planets, ships or communications stations in the "stellar communications" section of the program. Use the star charts to help identify the different constellations. The item you want to choose will be the one object shown on screen which isn't shown in the charts.

8. To recover the rocket, simply wait until the tide is on its way out. You must leave to fetch the rocket before the tide has completely withdrawn.

9. To complete the eclipse section of the program, first identify the type of eclipse. If the moon is between the Earth and the sun, it is a solar eclipse. If the Earth is between the moon and the sun, it is a lunar eclipse. Target the ship's exact location by moving the crosshair to the right position within the eclipsed area.

10. To transport the scientists to Jupiter near the end of summer, wait until Earth has moved just past the three o'clock position then fire your rockets. To return to Earth before Christmas, move the crosshair around Earth's orbit to the nine o'clock position, then fire your rockets.

Appendix A

Network and 3.5" Disk Versions

Loading *Astronomy* onto your Hard Disk

(MS-DOS versions only)

Instead of making a backup of the original Entrex 3.5" disk, you may copy the files onto a hard disk. Keep the files together in a separate directory and maintain the original disk in case the hard disk copy is damaged.

There is no copy protection on the disk, so it should be a simple matter of creating a new subdirectory on your hard disk (call it "Astro") then copy the files from the 3.5" disk into the subdirectory.

Multi-Load Feature & Custom Lab Packs

The older 5.25" disk versions were designed to allow teachers to make copies of the student disks, then boot the program on multiple computers using the one master disk supplied. Because all program files now reside on one 3.5" disk, this feature is no longer supported.

If you wish to load the program on more than one computer simultaneously, you may purchase as many extra disks as you require (creating your own custom lab pack). To purchase these disks, please provide proof of purchase of the original program to an Entrex dealer or distributor along with a purchase order specifying the number of extra disks you require. Disk prices will be available at all Entrex dealers and distributors.

Operational Differences

The 3.5" and Network versions of this product differ from earlier versions in several important ways. Please read the following carefully.

License Screen

The first time you load the program, you will have to identify yourself as the original purchaser of the program. Please type in your name or the name of the site (school name) in which the program will be used. You will also have to type in the version number of the program. The version number appears on the disk label.

Each subsequent time you load the program the screen will display a message similar to the following: "For the exclusive use of: (the name you typed in)."

Loading the Program

Follow the instructions detailed in the "Loading the Program" section of the manual. Unlike earlier versions there will be no need to exchange disks. Also, the 3.5" and network versions (MS-DOS versions only) will automatically load the simulation, bypassing the Teacher Options menu. If you wish to access that menu, you must select the *Utilities* command from the main command bar.

Note: selecting the *Utilities* command is the ***only*** way to access the Teacher Options menu, and thus the only way to access student record keeping, to change difficulty level, to clear sessions from saved files, etc. (see the section in the manual on Teacher Options & Utilities for more information on this part of the program).

Options & Utilities

The following options and utilities are no longer available:

Quick Boot: no longer applicable (MS-DOS versions only).

Copy Disks: no longer applicable. See the copyright and warranty section of this manual for your rights in copying your original Entrex 3.5" disk.

The following option has been added to the network version (MS-DOS versions only):

Set Pathname: this allows you to preset where saved sessions will be stored by students. The default pathname is A:\. This means whenever a student saves or restores a session, the program will look for a disk in drive A.

The following option has been changed on the 3.5" and network versions (MS-DOS versions only):

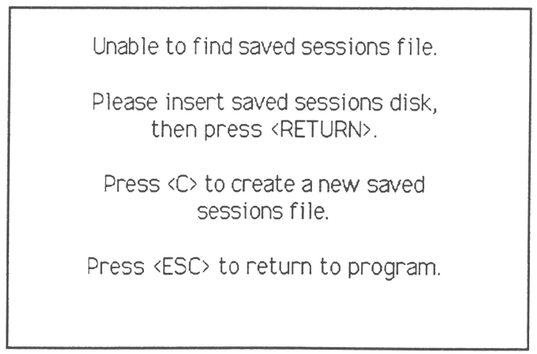
Quit: choose this option to return to DOS or to network log on/log off routines (previous versions do not exit to DOS).

Saving Sessions

In 3.5" versions, sessions will be saved to the 3.5" disk, or onto the hard disk if you have copied the program onto a hard disk. No new file will be created.

In Network versions, sessions will be saved to a file in a virtual volume located as per the *Set Pathname* option. The default pathname is A:/. In English, this means that when a student wishes to save a session, the program will look for a DOS formatted disk in Drive A, or in whatever drive (and directory) specified in the Set Pathname option.

If the program cannot find a saved sessions file on the appropriate disk, the following message will be displayed:


Unable to find saved sessions file.
Please insert saved sessions disk, then press <RETURN>.
Press <C> to create a new saved sessions file.
Press <ESC> to return to program.

If the student hasn't saved a session previously, he or she will probably have to create a new saved sessions file. Pressing <C> will create a small file on the disk, then will allow the student to save his or her session.

If the student has previously saved a session, simply insert the disk it was saved onto, then press <RETURN>.